The Eight Standards for Mathematical Practice (CCCSS)

Presented by

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Standard (CSTP)

3. Understanding and Organizing Subject Matter for Student Learning

3.1:
Demonstrating knowledge of subject matter, academic content standards, and curriculum frameworks

- Essential Questions:
- What are the Standards for Mathematical Practice?
- How might we connect our current instructional practice to the Standards for Mathematical Practice?

Objectives

- Content Objective:

  We will develop the understanding of California Common Core State Standards (CCCSS) and its Standards for Mathematical Practice.

- Language Objective:

  My team and I will report on the trends of a standard for Mathematical practice.

Agenda (9:00 – 10:30)

1. . The Standards for Mathematical Practice: Why is it important? (9:00 – 9:15)
   - Habits of mind
   - Preparing for college and career readiness
   - 21st century learning skills
   - Drives the Common Core instruction (K -12)

2. Overview of California Common Core State Standards (CCCSS) (9:15 – 9:30)
   - What are the Similarities and Differences between the current CST and CCCSS Assessment?

3.What are the Standards for Mathematical Practice? (9:30 – 10:00)
   Eight Standards: Non-verbal gestures and big ideas
   Assign teams for practice 2, 3, 4, 5, 6, 7, and 8
   Practice one will be modeled: Make sense of problems and persevere in solving them
   - On your chart paper, create a graphic organizer
   - Find the trends and patterns of the practice
   - Teaching strategies to connect to current instructional practice
   - Examples of student behavior
   - Non-examples of student behavior
   - Each team reports out the practice by using the graphic organizer and share a non-verbal gesture.

4. Independent Practice – Make and Take

Norms of the Session

- 1.
- 2.
- 3.

  – CFU: fist to five fingers
  – MaTHink & Yes
  – When I raise my hand and say…, please…

Standards for Mathematical Practice

1. **Make sense of problems and persevere in solving them**
2. **Reason abstractly and quantitatively**
3. **Construct viable arguments and critique the reasoning of others**
4. **Model with mathematics**
5. **Use appropriate tools strategically**
6. **Attend to precision**
7. **Look for and make use of structure**
8. **Look for and express regularity in repeated reasoning**

Standards for Mathematical Practice
Why is it important?

- Habits of mind
- Preparing college and career readiness
- 21st century learning skills
- Drive the Common Core Mathematics instruction

College and Career Readiness Standards

- The focus of the CCS is to guarantee that all students are college and career ready as they exit from high school.

What makes a student college ready ?
(Conley, 2008)

Cognitive strategies
Content knowledge
Self-management skills
Knowledge about postsecondary education

The Big Four

A comprehensive college preparation program must address four distinct dimensions of college readiness: cognitive strategies, content knowledge, self-management skills, and knowledge about postsecondary education.

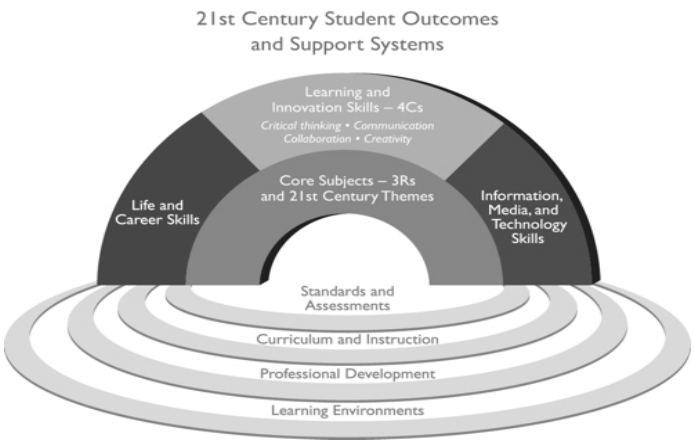
The Course Sequences That Have the Biggest Impact on College Success
(Creating Seamless Educational Transitions by ACT, 2010)

Rigorous curriculum = critical thinking + writing skills

- English 9-12
- Algebra 1, Geometry, Algebra II, and at least 1 upper level course, such as Trigonometry
- Biology, Chemistry, and Physics

Learning from Best Practice High Schools
(The Educational Policy Improvement Center, Bill & Melinda Gates Foundation)

1. Create and maintain a college-going culture
2. Align the core academic program with college readiness standards
3. Teach key self-management skills
4. Prepare students for the complexity of applying to college



Closing the Gaps of College and Career Readiness
(Innovate Ed, 2011)

- Ability to solve problems
- Interpret and use reasoning with precision and accuracy (key attributes)
- Academic behavior of self-monitoring & study skills that allow students to become self-directed learners

CCCSS

- California Common Core Sate Standards

Common Core State Standards

- the same for everyone
- fundamental knowledge needed to be college & career ready
- adopted statewide; not federal
- Shared, rigorous academic content with clear expectations for students

Two Key Points

• The Common Core is based upon the College and Career Readiness Standards developed previously by the NGA work groups. Everything was backwards mapped from this. This is a completely different process than the 1997 CA standards, where the document was developed grade by grade by comparing various standards and trying to pick out the "most rigorous expectations" with coherence across grades patched together at the end.

• As a result, the Common Core describe the overarching competencies that students need to develop, and then indicate how they progress across the grades. In contrast, the CA Standards breaks grade level skills into smaller and smaller sub skills, each of which (as explained in testimony to the SBE in 1997) are designed to be "testable" on a regular basis so they can be remediated as needed.

These include rigorous and relevant layers of visions!

The Common Core Standards

- Rigorous, research-based standards for English-language arts and mathematics for grades K-12
- Designed to prepare the nation's students with the knowledge and skills needed for success in college and the workforce
- Internationally benchmarked to ensure that students will be globally competitive
- A clear and consistent educational framework
- A collaborative effort that builds on the best of current state standards

PISA 2009

Overall Math Scale

Significantly Above OECD Average
Not Significantly Different (OECD Average 496)
Significantly below OECD Average

1	Shanghai-China	600
2	Singapore	562
3	Hong Kong-China	555
4	Korea	546
6	Finland	541
9	Japan	529
10	Canada	527
11	Netherlands	526
13	New Zealand	519
15	Australia	514
16	Germany	513
22	France	497
28	United Kingdom	492
31	United States	487
32	Ireland	487
34	Spain	483
38	Russian Federation	468
51	Mexico	419

PISA 2009

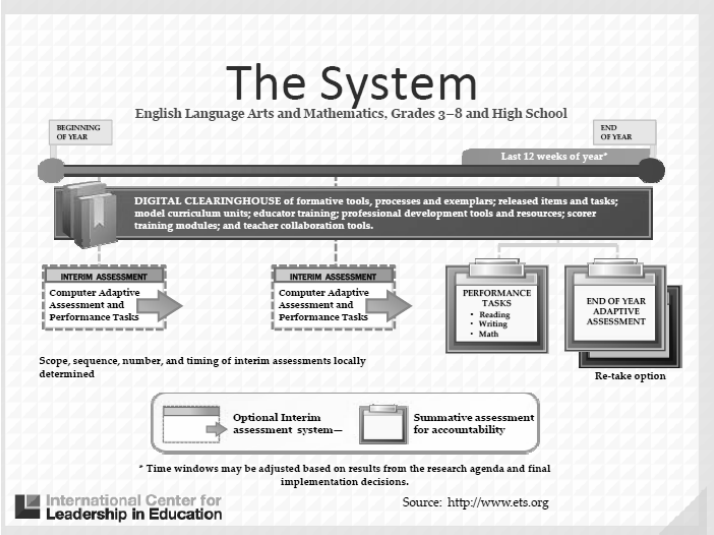
Overall Science Scale

Significantly Above OECD Average
Not Significantly Different (OECD Average 501)
Significantly below OECD Average

1	Shanghai-China	575
2	Finland	554
3	Hong Kong-China	549
4	Singapore	542
5	Japan	539
6	Korea	538
7	New Zealand	532
8	Canada	529
10	Australia	527
11	Netherlands	522
13	Germany	520
16	United Kingdom	514
20	Ireland	508
23	United States	502
27	France	498
36	Spain	488
39	Russian Federation	478
50	Mexico	416

Current Standards and CCCSS

- How different and similar are they?



K-8 Domain Progressions in CCSS

Domains	K	1	2	3	4	5	6	7	8
Counting and Cardinality									
Operations and Algebraic Thinking									
Number and Operations in Base Ten									
Number and Operations - Fractions									
Ratios and Proportional Relationships									
The Number System									
Expressions and Equations									
Functions									
Measurement and Data									
Geometry									
Statistics and Probability									

CCCSS

- K-8
  - Organized by grade level (K-8)
- High School Level
  - Organized by conceptual category
    - Number and Quantity
    - Algebra
    - Functions
    - Geometry
    - Modeling
    - Probability and Statistics

FORMAT OF K-8 STANDARDS

Operations and Algebraic Thinking 1.OA

Represent and solve problems involving addition and subtraction.

1. Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.

2. Solve word problems that call for addition of three whole numbers whose sum is less than or equal to 20, e.g., by using objects, drawings, and equations with a symbol for the unknown number to represent the problem.

Understand and apply properties of operations and the relationship between addition and subtraction.

3. Apply properties of operations as strategies to add and subtract. *Examples: If 8 + 3 = 11 is known, then 3 + 8 = 11 is also known. (Commutative property of addition.) To add 2 + 6 + 4, the second two numbers can be added to make a ten, so 2 + 6 + 4 = 2 + 10 = 12. (Associative property of addition.)*

4. Understand subtraction as an unknown-addend problem. *For example, subtract 10 – 8 by finding the number that makes 10 when added to 8.*

Domain Statement

Standard

Cluster

Domain Statement

Cluster

Standard

25

Overview of the Traditional Pathway for the Common Core State Mathemati

Courses

This table shows the domains and clusters in each course in the Traditional Pathway ... ch cluster included in that course are listed below each cluster. For each course, limits and focus for the clusters are shown in italics.

Domain

Conceptual Category

Clusters, Notes, and Standards

Domains	High School Algebra I	Geometry	Algebra II	Fourth Courses[1]
Number and Quantity: The Real Number System	•Extend the properties of exponents to rational exponents. N.RN.1, 2 •Use properties of rational and irrational numbers. N.RN.3			
Number and Quantity: Quantities	•Reason quantitatively and use units to solve problems. *Foundation for work with expressions, equations and functions* N.Q.1, 2, 3			
Number and Quantity: The Complex Number System			•Perform arithmetic operations with complex numbers. N.CN.1, 2 •Use complex numbers in polynomial identities and equations.	•Perform arithmetic operations with complex numbers. (+) N.CN.3 •Represent complex numbers and their operations on the complex plane

Rigor/Relevance Framework®

Re-sort the BLUE WWII strips onto the quadrants

Knowledge Taxonomy: 6 Evaluation, 5 Synthesis, 4 Analysis, 3 Application, 2 Comprehension, 1 Knowledge/Awareness

A: Acquisition — Assimilation

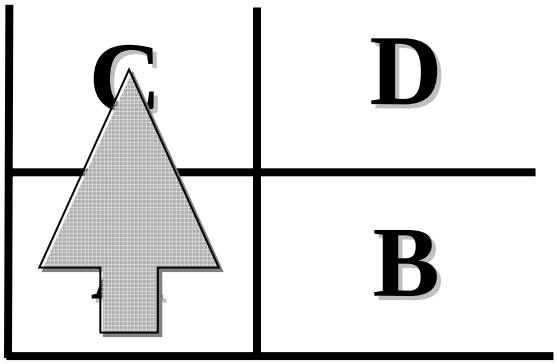
B: Application — Adaptation

C: Assimilation

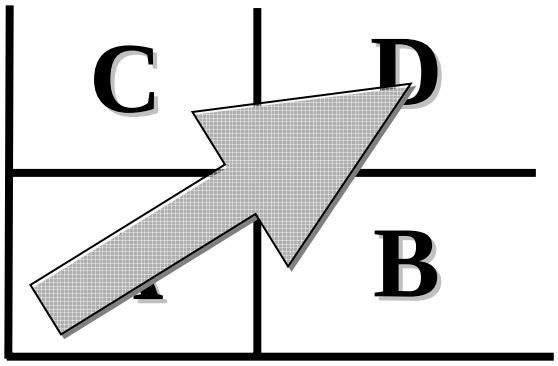
D: Adaptation

Application Model: 1 Knowledge in one discipline; 2 Apply in discipline; 3 Apply across disciplines; 4 Apply to real-world predictable situations; 5 Apply to real world unpredictable situations

Standards



Assessments

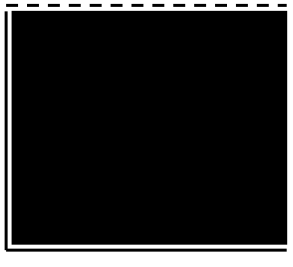


Students gather and store bits of knowledge/information and are expected to remember or understand this acquired knowledge.

Application 3

Comprehension 2

Awareness 1



1 Knowledge in one discipline

2 Apply knowledge in one discipline

A Quadrant

Verbs

- **name**
- **label**
- **define**
- **select**
- **identify**
- **list**
- **memorize**
- **recite**
- **locate**
- **record**

Products

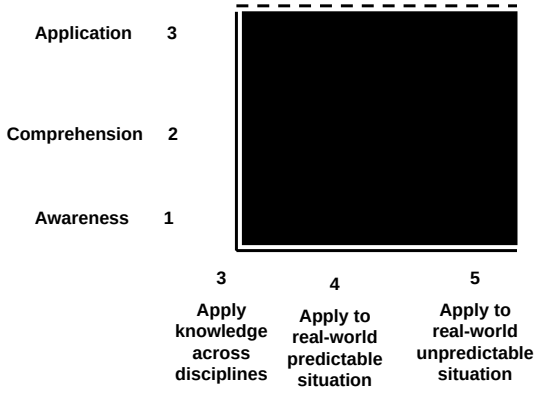
- **definition**
- **worksheet**
- **list**
- **quiz**
- **test**
- **workbook**
- **true-false**
- **reproduction**
- **recitation**

Quadrant A

Ask questions to recall facts, make observations or demonstrate understanding.

- What is/are__?
- How many__?
- How do/does__?
- What did you observe__ ?
- What else can you tell me__?
- What does it mean__?
- What can you recall__?
- Where did you find that__?
- Who is/was__?
- In what ways_?
- How would you define that in your own terms?
- What did/do you notice about this __?
- What did/do you feel/see/hear/smell __?
- What do you remember about _?
- What did you find out about __?

Students use acquired knowledge to solve problems, design solutions, and complete work.



B Quadrant

Verbs

- **apply**
- **sequence**
- **demonstrate**
- **interview**
- **construct**
- **solve**
- **calculate**
- **dramatize**
- **interpret**
- **illustrate**

Products

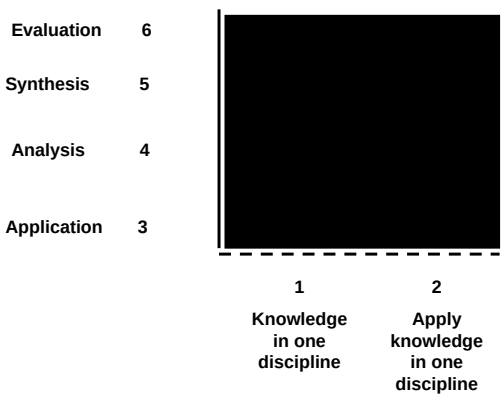
- **scrapbook**
- **summary**
- **interpretation**
- **collection**
- **annotation**
- **explanation**
- **solution**
- **demonstration**
- **outline**

Quadrant B

Ask questions to apply or relate.

- How would you do that?
- Where will you use that knowledge?
- How does that relate to your experience?
- How can you demonstrate that?
- What observations relate__?
- Where would you locate that information?
- Calculate that for __?
- How would you illustrate that?
- How would you interpret?
- Who could you interview?
- How would you collect that data?
- How do you know it works?
- Can you show me?
- Can you apply what you know to this real world problem?
- How do you make sure it is done correctly?

Students extend and refine their knowledge so that they can use it automatically and routinely to analyze and solve problems and create solutions.



C Quadrant

Verbs

- **analyze**
- **sequence**
- **annotate**
- **examine**
- **report**
- **criticize**
- **paraphrase**
- **calculate**
- **expand**
- **summarize**
- **classify**
- **diagram**

Products

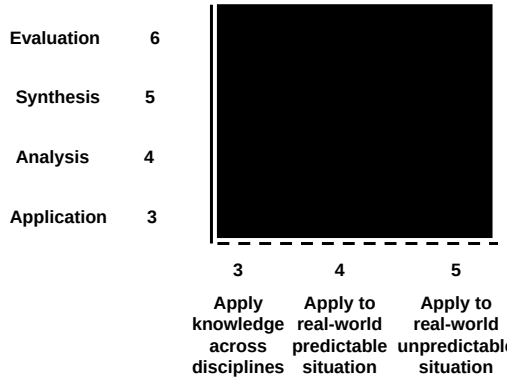
essay
abstract
blueprint
inventory
report
plan
chart
questionnaire
classification
diagram
discussion
collection
annotation

Quadrant C

Ask questions to summarize, analyze, organize, or evaluate.

- How are these similar/different?
- How is this like___?
- What's another way we could say/explain/express that?
- What do you think are some reasons/causes that _____ ?
- Why did __ changes occur?
- How can you distinguish between__?
- What is a better solution to__?
- How would you defend your position about__?
- What changes to __ would you recommend?
- What evidence can you offer?
- How do you know?
- Which ones do you think belong together?
- What things/events lead up to __ ?
- What is the author's purpose?

Students think in complex ways and apply acquired knowledge and skills, even when confronted with perplexing unknowns, to find creative solutions and take action that further develops their skills and knowledge.



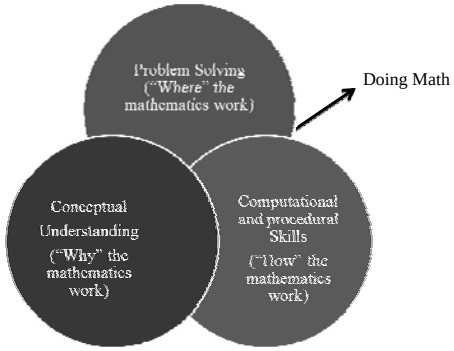
Quadrant D

Ask questions to predict, design, or create.

- How would you design a __ to __?
- How would you compose a song about__?
- How would you rewrite the ending of the story?
- What would be different today, if that event occurred differently?
- Can you see a possible solution to__?
- How could you teach that to others?
- If you had access to all resources how would you deal with__?
- How would you devise your own way to deal with__?
- What new and unusual uses would you create for__?
- Can you develop a proposal which would_?
- How would you have handled__?
- How would you do it differently?

Mathematical Proficiency

(as defined by the Current California Framework)



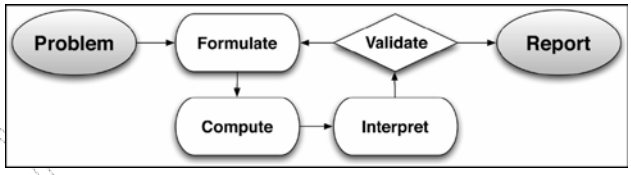
Essential Properties of Tasks That Assess: Four Claims

- Claim 1: Conceptual Understanding and Procedural Fluency
- Claim 2: Problem Solving
- Claim 3: Communicating Reasoning
- Claim 4: Mathematical Modeling

SMARTER

Claim #4: Mathematical Modeling

Modeling is the process of choosing and using appropriate mathematics and statistics to analyze empirical situations, to understand them better, and to improve decision-making. (p.72, CCSSM)



SMARTER Balanced Assessment Consortium

- What are the standards for Mathematical practice?

Mathematics/Standards for Mathematical Practice

1. **Make sense of problems and persevere in solving them**
2. **Reason abstractly and quantitatively**
3. **Construct viable arguments and critique the reasoning of others**
4. **Model with mathematics**
5. **Use appropriate tools strategically**
6. **Attend to precision**
7. **Look for and make use of structure**
8. **Look for and express regularity in repeated reasoning**

Practice 1

Make sense of problems and persevere in solving them

- Explain a problem to themselves, determine what it means, and seek possible entry points
- Analyze what's given, constraints, relationships, and goals
- Make conjectures about what the solution might look like
- Use multiple representations

Practice 2

Reason abstractly and quantitatively

- Make sense of quantities and their relationships in problem situations
- Decontextualize a problem
- Contextualize a problem
- Create a coherent representation of the problem, consider the units involved, and attend to the meaning of quantities

Practice 3

Construct viable arguments and critique the reasoning of others

- Understand and use stated assumptions, definitions, and previous results
- Analyze situations and recognize and use counterexamples
- Justify their conclusions, communicate them to others, and respond to arguments of others

Practice 4
Model with mathematics

- Apply the mathematics they know to solve problems in everyday life
- Analyze relationships mathematically to draw conclusions
- Interpret their mathematical results in the context of the situation and reflect on whether the results make sense

Practice 5
Use appropriate tools strategically

- Consider the available tools when solving mathematical problems
- Identify relevant external mathematical resources and use them to pose or solve problems
- Use technological tools to explore and deepen their understanding of concepts

Practice 6
Attend to precision

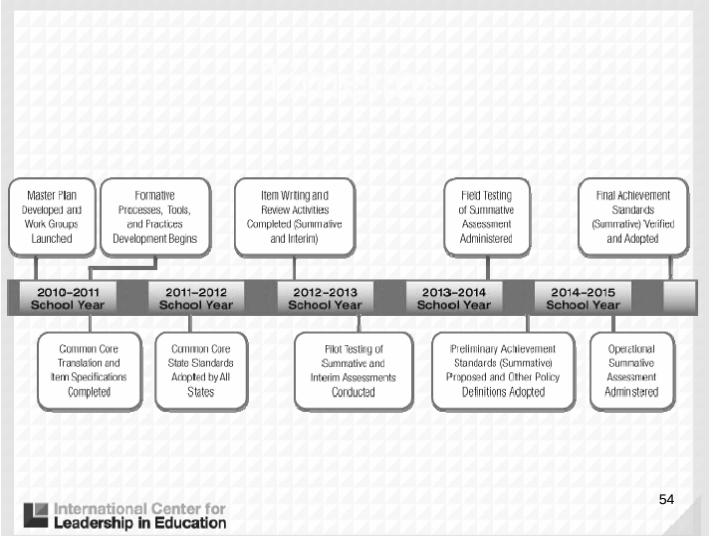
- Communicate precisely to others
- Use the equal sign consistently and appropriately
- Calculate accurately and efficiently
- Express measurements and numerical answers with a degree of precision appropriate for the context

Practice 7
Look for and make use of structure

- Look closely to determine a pattern or structure
- Utilize properties
- Decompose and recombine numbers and expressions
- Have the facility to shift perspectives

Practice 8
Look for and express regularity in repeated reasoning

- Notice if calculations are repeated, and look both for general methods and for shortcuts
- Maintain oversight of the process, while attending to the details
- Continually evaluate the reasonableness of their intermediate results



Did we attain our objectives?

- Content Objective:

  Did we develop the understanding of California Common Core's Standards for Mathematical Practice?

- Language Objective:

  Did my team and I report on the trends of the Standard for Mathematical Practice?